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Standardizing Nursing Information in Canada for Inclusion in Electronic Health Records: C-HOBIC

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Abstract The Canadian Health Outcomes for Better Information and Care (C-HOBIC) project introduced systematic use of standardized clinical nursing terminology for patient assessments. Implemented so far in three Canadian provinces, C-HOBIC comprises an innovative model for large-scale capture of standardized nursing-sensitive clinical outcomes data within electronic health records (EHRs). To support this activity, nursing assessment and outcomes concepts were mapped to the International Classification for Nursing Practice (ICNP®). By comparing serial data on a patient across multiple time points, the C-HOBIC model can generate nursing-sensitive patient outcome reports. A principle benefit of the C-HOBIC model is that it provides nurses with information critical to planning for and evaluating patient care. Inclusion of nursing information in either provincial databases or EHRs in three Canadian provinces promotes continuity of patient care across sectors of the healthcare systems in those provinces and also facilitates aggregation and analysis by administrators and policy makers. The C-HOBIC model provides standardized, consistent, interoperable clinical information that reflects nursing practice throughout the Canadian healthcare System.

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Introduction

Clinicians, researchers, administrative decision-makers and policy makers all face the critical challenge of how best to measure and improve the quality of healthcare delivery. While many kinds of health data are collected in Canada, information available to support decisions about patient outcomes remains scarce. Furthermore, there is a paucity of information in Canada and elsewhere related to nursing-sensitive patient outcomes. Better information is needed to evaluate the effectiveness and efficiency of health care processes and improve people's health.[1] Standardization of outcome data collection methods and the related terminology facilitates inclusion of such data in electronic health records (EHRs). These improvements facilitate comparison of information across practice settings, thereby promoting quality care.

There has been significant investment in EHRs in Canada and around the world. Frequently, the focus in Canada has been on the information needs of physicians. As a result, Canadian funding often has been directed to order entry or results reporting systems that focus on pharmaceuticals or diagnostics. While Canadian nurses use these functions to some extent, such functions provide little support for nurses' clinical judgments and decision making that are within the scope of nursing practice. Consequently, while nurses are the largest group of providers of care in the Canadian healthcare system, the care that they provide that impacts patients' clinical outcomes is essentially invisible in most EHRs. Furthermore, including in EHRs the information that is of value to nurses in planning for and evaluating patient care would better

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CNA is a federation of 11 provincial and territorial registered nurses associations representing Canadian registered nurses.

Canada Health Infoway is a Canadian federally funded, independent, not-for-profit organization and is the national-level catalyst for collaborative change to accelerate use of electronic health information systems and EHRs across Canada.

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engage nurses in the use of EHRs. The Canadian Health Outcomes for Better Information and Care project (C-HOBIC) is a first step in standardizing nursing-sensitive patient outcome information for inclusion in large jurisdictional EHRs.

Canadian Health Outcomes For Better Information and Care

In the fall of 2006, the Canadian Nurses Association (CNA)[2] partnered with the Ministries of Health in three Canadian provinces to submit a proposal to Canada Health Infoway, Inc (Infoway) to fund support of inclusion of nursing-sensitive patient information in EHRs. In May 2007, Infoway announced investment from its Innovation and Adoption Program for the Canadian Health Outcomes for Better Information and Care (C-HOBIC) project. C-HOBIC is sponsored by the CNA in partnership with the Ministries of Health of Ontario, Prince Edward Island, and Saskatchewan. In May 2008, the province of Manitoba, represented by Winnipeg Regional Health Authority, joined the C-HOBIC initiative.[3]

The C-HOBIC Objectives

The C-HOBIC project promotes widespread, systematic use in Canada of standardized patient assessments and standardized related documentation. The project thereby enables feedback to nurses about patient outcomes. The latter is achieved by comparing the same sets of patient assessment data at different points of time. Use of the International Classification for Nursing Practice (ICNP®), the standardized clinical reference terminology of nursing developed by the International Council of Nurses (ICN), facilitates extraction of information into relevant secure jurisdictional EHRs, data repositories, or databases. From those repositories, it is made available to nurses for use in patient care across four sectors—acute care, complex continuing care, long-term care and home care. In participating Canadian provinces, the C-HOBIC project encourages nurses to use EHRs by providing content in the EHR that is of use in nursing practice.

Background

Canadian Health Care Context

Canada has designed its healthcare system to ensure that all 33 million[4] residents have reasonable access to medically necessary hospital and physician services. The Canadian national healthcare system is composed of 14 interlocking provincial, territorial and federal health insurance plans that share certain common features. Delivery of health services is the responsibility of the provincial governments. Framed by the Canada Health Act, the principles governing collaboration among the provincial health care systems in Canada are Universality, Accessibility, Portability, Comprehensiveness, and Public Administration. Achieving collaborative action among the provinces on health issues is a matter of negotiation and compromise. As in other nations around the world, Canadian health care spending continues to rise. A commitment to eHealth[5] is viewed as an essential element of health care renewal and is expected to result in benefits to Canadians through improvements in system accessibility, quality and efficiency. Data and information about patient outcomes that are responsive to nursing actions have the potential to contribute to the enhancement of the quality and efficiency of patient care by nurses.

The CNA undertook the challenge of engaging in the negotiations necessary to achieve collaborative action on C-HOBIC among the participating provinces.

Towards a Pan-Canadian Electronic Health Record

Infoway defines an EHR as a secure and private lifetime record of an individual's health and care history, available electronically to authorized health care providers.[6] To date, the primary focus of Infoway's investments has been the creation of infostructure and standards. Core applications being deployed across Canada include (1) client and provider registries, (2) laboratory information systems, (3) diagnostic imaging systems, (4) pharmacy information systems, (5) telehealth systems, and (6) public health surveillance systems. These foundational systems, serving as feeder systems, provide the basis for provincial and territorial EHRs. Infoway has set a goal of achieving EHR use for 50% of all Canadians by 2010.[7] It is yet to be confirmed what key health data elements, beyond the data from the foundational and feeder systems, will comprise national and jurisdictional EHRs. Canadian nurses have been working to ensure that jurisdictional EHRs include patient centered perspective, and clinical outcomes data, such as in the C-HOBIC measures.

Identifying the Patient Outcomes

In 1998, the Ontario Ministry of Health and Long-Term Care established the Nursing and Health Outcomes Project. Its goals included: to identify patient outcomes that reflected nurses' contributions to patient care; to determine appropriate ways of measuring those outcomes; and to identify databases suitable for storing these outcomes. After an extensive and rigorous review,[8] an expert panel recommended eight nursing-sensitive patient outcomes encompassing 38 individual data elements to serve these purposes. The eight clinical outcomes each have a concept definition, an associated valid and reliable measurement instrument, and empiric evidence linking them to some aspect of nursing. Furthermore, data for these outcome measures can be collected using standardized tools across all sectors of the Canadian healthcare System.

The C-HOBIC Description

The C-HOBIC builds on and expands the original Ontario initiative. While the project sponsor, CNA, has a particular interest in a national clinical terminology standard to meet the needs of nursing practice, its overriding interest is in integration of clinical information from all healthcare providers to obtain the best information suitable for influencing patient outcomes. The CNA envisions standardized nursing assessment information collected in all provinces that is included in provincial EHRs, along with associated outcome information. Figure 1 illustrates the relationship between the nursing process and C-HOBIC collection of assessment and outcomes data.

Table 1 indicates how the 38 elements comprising the C-HOBIC dataset are used to address the eight outcomes. As shown in Table 1, twenty-six of the C-HOBIC data elements for seven of the outcomes are collected in all four sectors of the health system (Acute Care, Complex Continuing Care, Long Term Care, and Home Care), while other elements

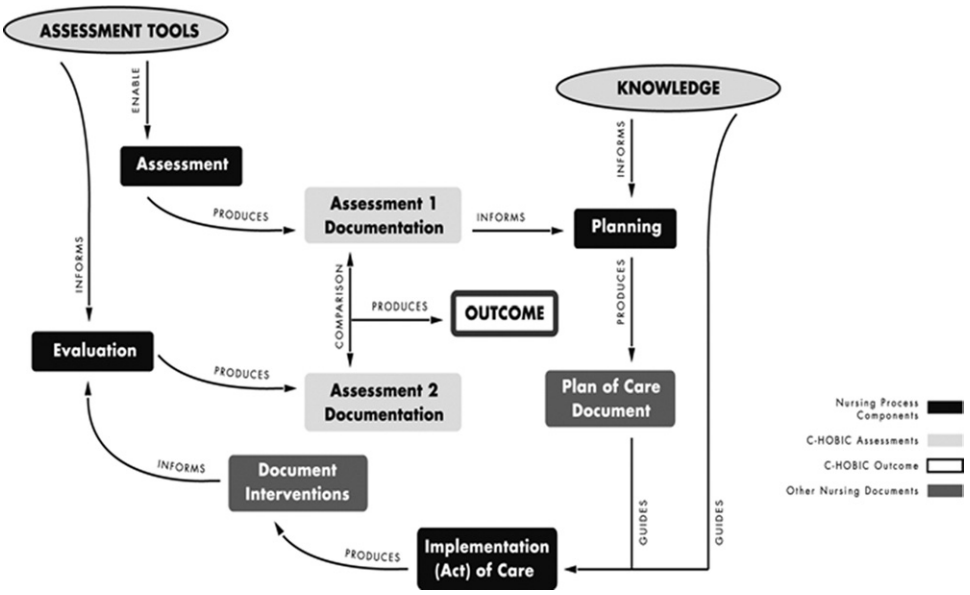

Figure 1. Relationship between C-HOBIC and the nursing process.

pertain only in a more precise form to particular sectors. Therefore, in some sectors, only the more precise form of the element is captured.

In addition, as shown in Table 2, another twelve data elements related to the eighth Outcome, Readiness for Discharge (Therapeutic Self-Care), are only gathered when patients are being assessed for discharge from Acute Care or Home Care.

C-HOBIC: Mapping to ICNP®

The International Classification for Nursing Practice® is endorsed by CNA for documentation of nursing practice in Canada.[9] As part of the C-HOBIC project, the concepts originally identified in Ontario were mapped to ICNP®. Specific details of the mapping process have been previously published in a complete report;[10] only the steps and final product are summarized herein. The ICNP®, Version 1.0,

Table 1 ■ C-HOBIC Assessment Data Elements for Seven Outcomes (All Sectors)

Outcome	Associated Assessment Data Elements	AC	CCC	LTC	HC
Functional status	ADL SELF-PERFORMANCE	✓	✓	✓	✓
	Bathing	✓			✓
	Personal hygiene	✓	✓	✓	✓
	Walking	✓			
	walking in room		✓	✓	
	walking in corridor		✓	✓	
	locomotion on unit		✓	✓	
	locomotion off unit		✓	✓	
	locomotion in Home				✓
	locomotion outside of home				✓
	Transfer		✓	✓	✓
	transfer toilet	✓			
	toilet use	✓	✓	✓	✓
	bed mobility	✓	✓	✓	✓
	Eating	✓	✓	✓	✓
	Dressing		✓	✓	
	dressing upper body				✓
	dressing lower body				✓
Pain	pain symptoms	✓			
	pain intensity level	✓	✓	✓	✓
	pain frequency		✓	✓	✓
Fatigue	inability to complete normal daily activities−	✓	✓	✓	✓
Dyspnea	for preceding 24 h	✓			
	for preceding 3 d		✓	✓	✓
Nausea	for preceding 24 h	✓	✓	✓	✓
Falls	Occurrence	✓	✓	✓	✓
Pressure ulcers	Number by stage	✓	✓	✓	✓

AC = Acute Care; ADL = activities of daily living; CCC = Complex Continuing Care; C-HOBIC = Canadian Health Outcomes for Better Information and Care; LTC = Long Term Care; HC = Home Care.

Table 2 ■ C-HOBIC Data Elements Related to the Readiness For Discharge (Therapeutic Self-Care) Outcome (two sectors only)

Outcome	Element	AC	HC
Readiness for discharge	knowledge of medications currently taking	✓	✓
	understand purpose of the medication	✓	✓
	ability to take medications as prescribed	✓	✓
	recognition of changes in body (symptoms) related to your illness	✓	✓
	understand why you experience some changes in your body (symptoms) related to your illness	✓	✓
	knowledge of what to do (things or activities) to control these changes	✓	✓
	ability to carry out the treatments or activities that you have been taught	✓	✓
	ability to do things or activities to look after yourself and to maintain your health	✓	✓
	knowledge of whom to contact to get help in carrying out your daily activities	✓	✓
	knowledge of whom to contact in case of a medical emergency	✓	✓
	able to perform regular activities (such as bathing, shopping, preparing meals, visiting with friends)	✓	✓
	able to adjust your regular activities when you experience body changes (symptoms) related to your illness	✓	✓

AC = Acute Care; C-HOBIC = Canadian Health Outcomes for Better Information and Care; HC = Home Care.

provided a standardized clinical terminology suitable for capturing, analyzing and reporting nursing-sensitive patient outcomes across diverse sectors of the health care system. The mapping also addressed the issue of proprietary vendor software by creating a coding set that allowed cross mapping. The C-HOBIC mapping involved creating conceptual and semantic matches between original concepts and specific terms in ICNP® Version 1.0.[11] The mapping process shown in Fig 2 resulted in terms that are uniquely reflective of nursing-sensitive patient outcomes.

The initial stage of the mapping involved analysis of the outcomes concepts identified in the original Ontario work. Each concept underwent review of its definition, conceptual meaning, and measurement scales specific to practice areas, i.e., acute care, complex continuing care, long term care, and home care. Meaning and intent for each concept were carefully preserved throughout to ensure accurate mapping. Similarly, ICNP® Version 1.0 was reviewed, both in content and structure. When a potential match was identified, term comparability was evaluated on the basis of conceptual equivalency, where definitions of both the originating concept and the ICNP® term were matched. Additionally, semantic equivalency was considered, where exact terms were identified as equivalent (i.e., "nausea" was mapped to "nausea", or "toileting" was mapped to "Ability to Toilet Self", etc). Where both conceptual and semantic equivalencies were confirmed, a C-HOBIC mapping to the ICNP term was created. Whenever multiple semantic or conceptual equivalencies were identified (i.e., mappings were not unique to a single target term), the C-HOBIC mapping options were recorded and set aside for future discussion and validation. Not all original concepts could be mapped to ICNP® V1.0. The ICN[12] readily affirms that the terminology continues to develop. Mapping challenges presented the opportunity for C-HOBIC to contribute to ongoing development of ICNP® V1.0 by identifying new terms and by generating a discussion of how to combine terms to fully express a concept.

In September 2007, initial mapping results were presented at a Canadian national forum comprised of nurses from academic settings, government ministries, policy institutions and practice environments. The forum also included international ICNP® experts. Forum participants reviewed, discussed, and validated both mapping results and mapping challenges. Table 3 provides an example of the final mapping results; complete results are available in the previously published report.[10]

At the conclusion of the mapping process, fifty-eight (58) original concepts were identified and validated as matched C-HOBIC terms, 13 of the original concepts were partially mapped and required a new ICNP® term for completion as C-HOBIC matched terms, and twenty-four (24) C-HOBIC terms were identified as suggestions for inclusion as new terms in ICNP®. Proposed new terms were submitted for approval to the ICNP® Project, and a C-HOBIC catalogue of precombined ICNP® terms was requested.

The C-HOBIC Processes

Engaging Nurses in the Use of Standardized Information

To achieve successful transformation of processes for managing clinical information, addressing aspects of cultural change is key. Nurses embrace change when they perceive that it benefits patients/clients. The C-HOBIC initiative educates its nurse-users about how to document patient

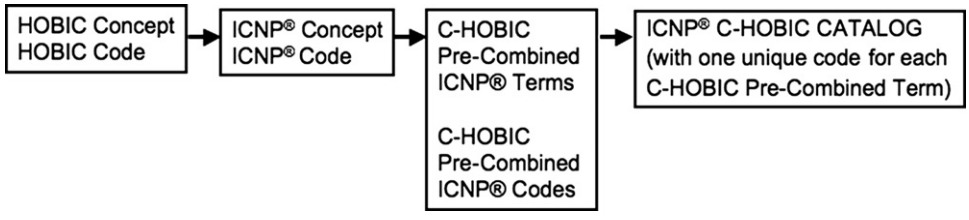

Figure 2. C-HOBIC Mapping Process.

Table 3 ■ Mapping Results (Example Only): Functional Status (ADL) Terms for Acute Care Domain

Item	HOBIC Concept	HOBIC Code	C-HOBIC Pre-Combined ICNP® Term	Code
Functional Status/ADL interRAI AC:GI	AC	0 – Independent	Dependent/Never	10005778/10013173
		1 – Set up help only	Dependent/Minimal	10005778/(new code)
	ADL SELF-PERFORMANCE – Assess for performance over full 24 hours, considering all occurrences of activity	2 – Supervision	Dependent/Minimal	10005778/(as above)
		3 – Limited Assistance	Dependent/Minimal	10005778/(as above)
		4 – Extensive Assistance	Dependent/Partial	10005778/(new code)
		5 – Maximal Assistance	Dependent/Extensive	10005778/(new code)
		6 – Total Dependence	Dependent/Complete	10005778(new code)
	Bathing		Ability to Bathe	1000121
	Personal Hygiene		Ability to Groom Self	1000178
	Walking		Ability to Walk	1000258
	Transfer Toilet		Ability to Transfer	1000204
	Toilet Use		Ability to Toilet Self	1000197
	Bed Mobility		Bed Mobility	1000181
	Eating		Ability to Feed Self	1000166

ADL = activities of daily living; HOBIC = Health Outcomes for Better Information and Care; AC = acute care.

assessments using project instruments, and as also how to interpret and using the resultant C-HOBIC information to evaluate the effects of the care they provide, i.e., patient outcomes. Nurses using C-HOBIC gain the ability to determine whether a patient's status is changing because of the care provided. The C-HOBIC model provides feedback to nurses via graphical displays to assist in patient care evaluation.

Whenever possible, implementation teams revised the documentation modules in existing electronic health information systems, e.g., EHRs or HIS, to include C-HOBIC data elements. Implementation teams continue to work with clinical system vendors to enable seamless transmission of demographic and C-HOBIC data from proprietary EHRs to each centralized provincial database, or jurisdictional EHR, in a manner that minimizes impact on local systems. Given the multiple vendor products in use across Canada, a variety of solutions have been developed, and these initial efforts will inform future work to ease subsequent implementations.

Additionally, C-HOBIC makes information available at the nursing unit level to nurse managers and executives so they can review quality of care measures for their unit or organization. They can benchmark their unit's patient outcomes versus similar units. The C-HOBIC results help nurse manager to develop best practices based on feedback from the nursing practice information. For example, feedback can assist in nursing management of a patient's fatigue or more efficient nursing preparation of patients for discharge.

Availability of C-HOBIC information challenges nurse administrators and educators to find new ways to assist practicing nurses individually and collectively. Outcomes data can inform initial patient care planning, as well as implementation and later modification of the care plans. Emphasis is on the role of the nurse manager as facilitator or change agent. Depending on the environment and resources, others—such as educators, clinical nurse specialists, or registered nurses at long term care sites—may equally take up the role of change agent to facilitate cultural shifts towards outcome-focused nursing practices.

Sustaining the Change

Sustaining change is an important aspect of any initiative. As one of its principal components, the C-HOBIC project engages key stakeholders within the nursing community. Through various forums, the C-HOBIC team works diligently to ensure that nurses are aware of the project, and that there is widespread understanding of the project's scope and benefits. One focus of C-HOBIC activity has been to work with faculty in colleges and universities in participating Canadian provinces to incorporate into their nursing curricula more information about standardized clinical terminology, standardized clinical assessment, nursing-sensitive outcomes and "outcomes focused care". This process ensures that graduating nurses enter practice with C-HOBIC relevant knowledge.

Validation Status

The small suite of C-HOBIC assessment instruments, data elements and associated patient outcome information is not disease specific. While organizations may choose to include other evidence-based, disease-specific measures for use at the local level, at this writing only 38 C-HOBIC data elements are being extracted from local patient records for compilation at the provincial level. As of Dec 31, 2008, 82 sites in Ontario are submitting C-HOBIC data to the provincial database (22 acute/complex and 60 long-term care homes). Implementation of C-HOBIC data capture in Saskatchewan is approximately 60% completed in the Saskatoon Health Region (30 facilities totalling 2131 Long Term Care beds). Nurses there are initially gathering a subset of C-HOBIC measures with the strategy of moving forward to the complete set when the provincial EHR is implemented. The primary focus in Saskatchewan is on providing feedback about patient outcomes to nurses and facilitating nurses' use of outcome data in planning and revising care of patients. In Manitoba, Winnipeg Regional Health Authority is implementing C-HOBIC for 1,005 long-term care beds and 3,300 home care clients. As in Saskatchewan, Manitoba nurses will initially gather a subset of C-HOBIC measures with the strategy of moving forward to the complete set as the provincial EHR is implemented.

Discussion

Lessons Learned

There is significant support from the Canadian nursing community and other key healthcare leaders in each partic-

ipating province. Nevertheless, C-HOBIC implementation has faced some challenges. One lesson learned is that when nurses enter clinical information into information systems, the architecture often does not support providing feedback to them in real time. For clinicians to value and use information systems, it is essential that they provide timely feedback to allow the clinicians to see the impact of the care that they provide.

Implementation of online clinical documentation is often one of the last applications that healthcare facilities introduce. In several instances, C-HOBIC provided organizations with an impetus to initiate a clinical documentation project. At other sites, the C-HOBIC project influenced implementation of the sites' chosen proprietary vendor solutions. While the C-HOBIC implementation effort focuses on embedding the standardized data elements into existing systems post facto, there is an opportunity to influence the design of next generation clinical information systems. The growing array of implemented C-HOBIC sites, and national attention garnered by the C-HOBIC project, has caught the attention of system vendors. They have participated in dialogues to facilitate inclusion of C-HOBIC data elements as standard components of their future clinical documentation modules. This development is mutually beneficial in that, for nursing, such collaboration supports broader use of the C-HOBIC measures and will decrease the startup costs now associated with C-HOBIC current implementations. For vendors, C-HOBIC collaborations can increase the attractiveness of their future products in the Canadian marketplace.

Nevertheless, for present-day systems, a second challenge associated with C-HOBIC implementation has been the difficulty of introducing standardized information into the proprietary clinical information systems. Several organizations were already well advanced in the building and implementation of their clinical documentation systems with resources committed and timelines established. Any change in a project plan poses potential risks to completion, due to the complexity of this type of work. While there is interest in C-HOBIC, many sites previously committed to other initiatives, with associated timelines and resource constraints, and those sites cannot afford to jeopardize their current projects. Most have agreed to work with their vendors to introduce the C-HOBIC suite of standardized measures and use standardized clinical terminology as they undertake future systems upgrades.

Benefits of Standardized Clinical Information (C-HOBIC)

Benefits to End Users

As previously noted, adding C-HOBIC to an EHR system increases nurses' interest in, and commitment to, using the EHRs system, because it then includes more information of value to nursing practice. The C-HOBIC model is beginning to allow nurses to see the impact of their efforts on patient outcomes.

Benefits to People within the Health Care Systems

As EHRs are developed, it is critical that they include all the information important to patient management in all sectors, as people move within and throughout the Canadian healthcare System. In the absence of established international or national standards for collecting and managing clinical outcomes data, clinical system vendors have developed proprietary approaches to clinical data. Hence, as people move through the healthcare system, each sector (e.g., acute care, home care, long term care) has its own software systems and vendors. There is little or no standardized clinical information that easily transfers across these sectors, and this compromises continuity and quality of patient care. Metrics must be developed to document that, in aggregate, the various sectors meet a patient's healthcare needs.[13] The C-HOBIC project provides a standardized suite of patient-centered data collection and outcomes analysis tools that can function across all sectors of the healthcare system to ensure that patient outcome information is available.

Benefits to Decision Makers and Policy Makers

The effectiveness of a healthcare system should be judged by how well it provides patient-centered, efficient and effective care that results in improved measures of patients' functionality and quality of life. Through use of aggregated C-HOBIC information, participating Canadian provinces are beginning to provide nursing administrators with the means to understand how well their organization is managing outcomes. Similarly, policy makers are beginning to examine how well the system is meeting patients' needs. For example, some healthcare system administrators now use C-HOBIC to determine what optimal interdisciplinary composition of teams should be to deliver the most effective care for specific types of patients, or to optimize the number of nurses and hours of nursing care per patient day for various hospital and nursing home units.

Conclusions

The C-HOBIC model provides clinical outcomes data that are based on collecting standard elements of patients' health status information that nurses assess every day in their practice. The uniqueness of the model, with its small suite of assessment tools, data elements and the associated outcomes, is that the data are gathered consistently using standardized clinical terminology that allows for abstraction into a provincial database or EHR for comparison across settings in the continuum of health care. Although the C-HOBIC assessment measurements, data and outcomes do not comprehensively cover all aspects of nursing care, they are robust and sensitive to changes in patient's status. Use of C-HOBIC adds little or no clinical burden for nurses, because nurses are already assessing their patients. The C-HOBIC assessment instruments merely provide nurses with a standardized way of recording what they do. Furthermore, the limited size of the suite of C-HOBIC data elements does not represent a great burden for nurses to measure and document. Entering the data allows C-HOBIC to provide feedback to nurses in manner appropriate for practice settings. The consistent use of standardized assessment instruments by nurses, with the resulting feedback about patient outcomes, fosters nursing use of EHRs.

The widespread introduction of standardized nursing terminology has been well received by vendors. Use of ICNP® in jurisdictional databases and provincial EHRs greatly facilitates interoperability and sharing of nursing information across sectors of the Canadian healthcare system, as the single largest group of clinicians in any healthcare delivery system, nurses' adoption and use of clinical information systems is pivotal to

the success of EHRs. Historically, international efforts in nursing informatics often focused on educating nurses about how to use computers and information systems to enter patient data or to document patient care for communication or legal reasons. There has been little emphasis on giving nurses information about their practice based on the information they gather.[14] As EHRs become more prominent in health care, and more information about the outcomes of nursing care is available to nurses, the culture of nursing will shift from task-oriented focus to outcomes-related focus. The C-HOBIC project extends the functionality of the EHR from the nursing perspective. It transforms EHRs from merely communicating information for use by non-nursing professionals, to gathering and analyzing information that enables nurses to assess the impact of their practice on patient outcomes in all settings.

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